EPA United States Environmental Protection Agency

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Breaking the Cycle

2001-2002

PBT Program Accomplishments

Pollutants that are persistent, bioaccumulative, and toxic have been linked to numerous adverse effects in humans and animals. The United States has taken extensive action over the years to address these pollutants. But such pollutants not only remain in the environment for years and even decades, they also travel far beyond their initial points of release, posing threats across national and geographic boundaries. Only by addressing the threat of these pollutants on a global scale can we help to meet our goal of leaving America's air cleaner, our water purer, and our land better protected.

— Christine Whitman, EPA Administrator

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CHAPTER 1: **INTRODUCTION**

Chemicals are used to produce many of the items that we depend on in our daily lives. While useful, chemicals are often a cause for concern due to their toxic properties. Toxic chemicals that are also persistent and bioaccumulative, such as mercury, dioxins and furans, polychlorinated biphenyls (PCBs) and some pesticides, deserve special attention. These persistent, bioaccumulative, and toxic (PBT) substances are released into the environment, persist in ecosystems, and often linger there in some form for decades,

cycling between land, water, and air. As aquatic and terrestrial organisms repeatedly consume and store PBTs in their body fat, these substances bioaccumulate up the food chain. Most human exposure to PBTs occurs through the consumption of contaminated foods. A range of adverse health effects (e.g., reproductive, developmental, behavioral, neurologic, endocrine, and immunologic) have been linked to PBTs. Because many PBTs can be transported by wind and water, it is possible for PBTs generated in one country to affect people and wildlife far from the source.

In its mission to protect human health and the environment, the U.S. Environmental Protection Agency (EPA) has regulated the use and release of the most harmful PBTs. While these regulations have been effective in controlling industrial and municipal sources of PBTs, runoff, fugitive sources, and background levels of PBTs have proven harder to manage. Therefore, in 1998, EPA created the Persistent, Bioaccumulative, and Toxic (PBT) pollutants Program to address, using an integrated approach, the widespread problems associated with toxic pollutants that persist and bioaccumulate in the environment. EPA also created the Multimedia Pollution Prevention (M2P2) Forum, a group of senior managers representing each of EPA's program offices, to provide guidance to the PBT Program.

The M2P2 Forum deliberates on EPA's PBT policies and also communicates with several partners, including other federal agencies, state representatives, and international organizations, to resolve common concerns regarding PBTs. In collaboration with these partners, the PBT Program had several noteworthy achievements in 2001-2002:

- **Released final National Action Plan for Alkyl-lead.** This document is the first final EPA national action plan for a priority PBT under the Agency-wide PBT Program. The plan lists specific goals and priorities for action for alkyl-lead.
- **Released the PBT Profiler.** The PBT Profiler is a Web-based analytical tool designed to help companies determine whether a chemical might have PBT properties.
- **Expanded membership in the Hospitals for a Healthy Environment (H2E) Program.** This voluntary program calls on hospitals and health care facilities to pledge to eliminate mercury use by 2005. To date, the program has recruited 324 hospitals, 586 clinics, 15 nursing homes, and 29 other facilities.

- **Analyzed data from the National Health and Nutrition Examination Survey (NHANES).** Based on NHANES data from 1999 and 2000, EPA estimates that 8 percent of women of childbearing age have blood mercury concentrations higher than the level that EPA considers safe.
- **Researched trends on atmospheric mercury deposition.** EPA has uncovered new information that implies that all forms of mercury must be controlled to effectively reduce atmospheric deposition.
- **Collected additional data on PBTs through the Toxic Release Inventory (TRI).** The 2002 TRI report contains newly included data on PBTs, giving communities a more complete picture of the sources of chemicals in their environments.

These accomplishments, as well as several others, are described in further detail in subsequent chapters of this report. The report contains the following information:

- **Chapter 2: Strategies for Addressing PBTs.** This chapter provides a synopsis of the PBT Program's priority activities, including its PBT Strategy and national action plans for priority pollutants.
- **Chapter 3: Achieving Pollution Reductions.** This section highlights recent efforts of the PBT Program to coordinate and enhance EPA's mission of decreasing PBT contamination in the environment.
- **Chapter 4: Filling the PBT Data Gaps.** In 2001-2002, EPA initiated or continued projects designed to discover key information about the sources of PBTs, their life cycle in the environment, as well as the levels of PBTs present in humans and wildlife. This research allows EPA and others to determine the most appropriate PBT-related policies and courses of action.

- **Chapter 5: Collaborative Efforts on PBTs with Tribal Partners.** Many tribes, especially those in Alaska and other parts of the Arctic, rely on subsistence diets that include much more fish than the average American eats. Some tribes are also particularly reliant on the consumption of animals that are high on the food chain. Subsistence hunters and fishermen are one of the highest risk groups for PBT exposure, thus fostering partnerships in tribal communities is particularly important.
- **Chapter 6: Collaborative Efforts on PBTs with International Partners.** This chapter describes efforts of the United States and its international partners to reduce the global use and release of PBTs.
- **Appendix A: Resources.** This section provides additional sources of information about many of the projects described in the body of the report.
- **Appendix B: Future Outlook.** This section summarizes future activities planned by the PBT Program.

CHAPTER 2: **STRATEGIES FOR ADDRESSING PBTs**

EPA actions to reduce PBT releases have traditionally been separate regulatory activities aimed at different environmental media (i.e., air, water, or land). The PBT Program helps to coordinate these activities to ensure, for example, that regulations removing a pollutant from the air do not inadvertently result in transferring the pollution to land or water. In November 1998, the PBT Program published its draft *Multimedia Strategy for Addressing Priority PBTs* (the PBT Strategy). EPA revised the PBT Strategy to

incorporate public comments and is currently finalizing the document. The PBT Program is also developing national action plans to address specific issues associated with eight priority PBTs or groups of PBTs (see Table 1). Together, the PBT Strategy and national action plans enable the Agency to harness all of its tools—voluntary, regulatory, international, enforcement, compliance, and research—and focus them on a group of substances that have long-term and far-reaching effects on our well-being.

The PBT Strategy

The goal of the PBT Strategy is to reduce risks to human health and the environment from current and future exposure to PBTs. The PBT Strategy identifies general issues that apply to PBTs, such as long-range transport via air deposition and human exposure to PBTs through the food chain. Solving these problems requires action on several fronts:

- Preventing the introduction of new PBTs.
- Reducing the use and release of existing PBTs.
- Improving our understanding of how PBTs cycle in the environment and the routes of human exposure to PBTs.
- Communicating the risks of PBT exposure, especially to sensitive populations.
- Working globally to diminish the long range transport of PBTs.

The projects described in this report use these approaches to address PBTs.

National Action Plans for Priority PBTs

The national action plans look at each priority PBT or group of PBTs in detail, outlining goals and important activities to reduce the negative effects of each substance on human health and the environment. Table 2 describes each priority PBT and the status of its national action plan.

Table 1. Priority PBTs

- Alkyl-lead
- Benzo(a)Pyrene
- Dioxins/Furans
- Hexachlorobenzene
- Mercury and Mercury Compounds
- Octachlorostyrene
- Pesticides:
  - Aldrin/Dieldrin
  - Chlordane
  - Endrin
  - Dichlorodiphenyltrichloroethane (DDT) (+DDD & DDE)
  - Heptachlor
  - Mirex
  - Toxaphene
- Polychlorinated Biphenyls (PCBs)

Table 2. Description of Priority PBTs and Status of EPA Activities

PBT OR PBT GROUP	DESCRIPTION	HUMAN HEALTH AND ECOLOGICAL EFFECTS	SOURCES AND ROUTES OF HUMAN EXPOSURE	FOCUS OF NATIONAL ACTION PLAN	STATUS OF NATIONAL ACTION PLAN DEVELOPMENT
Alkyl-lead	The vast majority of lead chemical compounds are inorganic. However, lead can be combined with organic chemicals to form lead compounds with very different characteristics from metallic lead. Alkyl-lead is one of the more predominant types of organic lead compounds.	Human health effects: serious toxic effects to the nervous system, with the potential to cause neurological disorders, such as mood shifts and impairment of memory. Children and certain occupational groups may be most at risk. Ecological effects: Alkyl-lead and other organic lead compounds have been found to significantly bioconcentrate in aquatic organisms (e.g., fish and shellfish), although the biomagnification of organic lead compounds has not been shown.	Main Source: fuel additive for racing gasoline and piston-engine aircraft. Human exposure: inhalation of leaded gasoline vapors or dermal exposure to leaded gasoline.	Continued partnership with the National Association for Stock Car Automobile Racing (NASCAR) to permanently remove alkyl-lead from racing fuels. Work with the Federal Aviation Administration (FAA) and appropriate private parties to identify substitutes for alkyl-lead compounds in aviation gasoline.	In July 2002, EPA released the final National Action Plan for Alkyl-lead.
Benzo(a)Pyrene (B(a)P)	B(a)P is a member of a class of compounds known as polycyclic aromatic hydrocarbons (PAHs). PAHs are primarily by-products of incomplete combustion.	Human health effects: probable human carcinogen. Ecological effects: There is evidence of carcinogenicity in animals. Animal studies also suggest that there are developmental and reproductive problems associated with long-term exposure.	Largest sources of B(a)P: forest and agricultural burnings; residential wood combustion; primary aluminum production; mobile sources; and open burning of scrap tires. Main routes of human exposure: inhalation of tobacco smoke; ingestion of smoked or char-broiled food; exposure during work involving coal tar and asphalt.	Research is a high priority since there is little data characterizing the relationship between emission sources and current exposure and risk. EPA is researching the relationship between risk and emission sources such as forest fires, agricultural burning, residential wood and coal combustion, scrap tire management, and industrial boilers. Other federal, state, and local programs address exposure to B(a)P through the inhalation of tobacco smoke, ingestion of smoked or char-broiled food, and occupational exposure.	The draft National Action Plan for B(a)P will be made available to the public for comment before the final version is released.

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Dioxins/Furans	The term "dioxins" refers to a group of 29 chemical compounds that are members of three closely related families: polychlorinated dibenzo-p-dioxins, polychlorinated dibenzofurans, and certain polychlorinated biphenyls (PCBs) called coplanar PCBs.	The most studied dioxin compound, 2,3,7,8-TCDD, has been characterized as a human carcinogen. Other dioxin-like compounds have been characterized as likely human carcinogens. Non-cancer health effects include reproductive and developmental toxicity, immune suppression, endocrine disruption and chloracne. Ecological effects: Effects found in humans are typical in most vertebrates. These adverse effects have been seen in field and laboratory studies in birds and fish. The disruption of fish reproduction is seen as a particularly sensitive ecological endpoint.	Dioxins are unintended byproducts of a number of processes including: chemical manufacture; metals smelting and production; and various forms of combustion, ranging from energy production to backyard trash burning. When dioxins and furans are released to the air they can be carried for long distances. Some of this material is deposited on the leaves of plants that are used as feed for livestock. Consequently the dioxins bioconcentrate in domestic meat and dairy animals. Dioxins can also enter waterways, where they may bioconcentrate in fish. Humans are exposed to dioxins primarily through diet, namely from eating trace levels of dioxins found in the animal fats of beef, pork, poultry, milk, and dairy products.	EPA has developed a three-pronged approach to address remaining dioxin risks in the environment. First, EPA is continuing to complete and implement regulations to reduce and control known dioxin sources into the environment. (When fully implemented over the next couple of years, existing regulations will result in over 90 percent reduction in quantifiable dioxin emissions using 1987 as a baseline.) Second, in cooperation with other federal and state agencies, EPA is continuing its research efforts to identify dioxin sources and routes of exposure. Third, the Agency is developing a strategy to identify opportunities to further reduce exposures to dioxin that will yield efficient and effective risk reductions. EPA will continue to work closely with its other federal partners, including the Department of Health and Human Services (HHS), the U.S. Department of Agriculture (USDA), and other agencies. Dioxins/furans are also listed under the Stockholm Convention on Persistent Organic Pollutants (POPs) and the Long Range Transport of Air Pollution (LRTAP) POPs Protocol. See Chapter 6 for more information.	An EPA Strategy on Dioxin will be released in 2003.

Table 2. continued

PBT OR PBT GROUP	DESCRIPTION	HUMAN HEALTH AND ECOLOGICAL EFFECTS	SOURCES AND ROUTES OF HUMAN EXPOSURE	FOCUS OF NATIONAL ACTION PLAN	STATUS OF NATIONAL ACTION PLAN DEVELOPMENT
Hexachlorobenzene (HCB)	HCB is a highly persistent environmental toxin that was synthesized and used from the 1940s to the late 1970s as a fungicide on grain seeds such as wheat. HCB is no longer produced for distribution in commerce although it may be produced in the United States as a site-limited intermediate under an exemption to the UNEP POPs agreement.	Human health effects: probable human carcinogen. Ecological effects: HCB bioaccumulates in fish, marine animals, birds, lichens, and their predators. HCB has been found in fish and wildlife at various locations throughout the U.S., though the Great Lakes and Gulf coast are areas with elevated concentrations.	HCB is formed as an inadvertent by-product in the production of pesticides, chlorine, and in chlorination processes. Long-range atmospheric transport and deposition from global sources are also thought to contribute to loadings within the United States. Main route of human exposure: ingestion of HCB-contaminated meat, dairy products, poultry, fish, and wildlife. The general population appears to be exposed to very low concentrations of HCB.	EPA's strategic approach with respect to HCB consists of: 1) collecting information to characterize sources and pathways in the lifecycle of HCB; 2) achieving a significant reduction in total air emissions from inventory sources of HCB, using 1993 HCB levels; 3) minimizing controlled and uncontrolled multimedia transfers of HCB; and 4) determining the extent of HCB contamination from long-range transport and working within international frameworks to reduce releases of HCB worldwide. HCB is also listed under the Stockholm Convention on Persistent Organic Pollutants (POPs) and the Long Range Transport of Air Pollution (LRTAP) POPs Protocol. See Chapter 6 for more information	EPA intends to publish the final National Action Plan for Hexachlorobenzene in 2003.

PBT OR PBT GROUP	DESCRIPTION	HUMAN HEALTH AND ECOLOGICAL EFFECTS	SOURCES AND ROUTES OF HUMAN EXPOSURE	FOCUS OF NATIONAL ACTION PLAN	STATUS OF NATIONAL ACTION PLAN DEVELOPMENT
Mercury	Mercury is a naturally occurring element that is usually mobilized and released to the environment as a result of human activities. Just a small amount of mercury can contaminate an entire lake, resulting in mercury levels in fish that exceed recommended limits for human consumption, and endangering predatory wildlife.	Human health effects: Exposure to high levels of mercury can permanently damage the brain and kidneys. Very young children are more sensitive to mercury than adults. Harmful effects that may be passed from the mother to the fetus include brain damage, mental retardation, incoordination, blindness, seizures, and inability to speak. Children poisoned by mercury may develop problems of their nervous and digestive systems, and kidney damage. Ecological effects: Predatory fish and other species, such as mink, river otter, marine mammals, kingfisher, loon, osprey, and bald eagle which are at the top of the food web and consume contaminated aquatic organisms, generally have higher mercury concentrations and subsequently are at an increased risk of adverse effects. Reported effects for these predator species have included neurological damage and reduced reproductive levels.	Largest sources of mercury release to the environment: coal-fired power plants, incinerators. Routes of human exposure: Ingestion of fish or shellfish contaminated with methylmercury; inhalation of mercury vapors from a spill.	EPA is focusing its efforts on the following priority activities: 1) reducing anthropogenic release of mercury; 2) reducing exposure to mercury by improving risk communication; 3) reducing uses of mercury; 4) conducting and reviewing research on disposal of mercury; 5) investigating life-cycle issues associated with mercury as a global commodity. In addition, the United Nations Environment Programme (UNEP) completed in 2002 a global assessment of mercury in collaboration with governments, intergovernmental and non-governmental organizations and the private sector. In February 2003, the UNEP Governing Council accepted the key findings of the assessment and agreed on a program for international action on mercury. The UNEP mercury program will assist all countries, especially developing countries and countries with economies in transition, with capacity building activities to characterize their mercury pollution problems and to develop appropriate strategies to mitigate mercury pollution problems. See Chapter 6 for more information.	EPA intends to re-release the draft National Action Plan for Mercury for public comment in late 2003.

Table 2. continued

PBT OR PBT GROUP	DESCRIPTION	HUMAN HEALTH AND ECOLOGICAL EFFECTS	SOURCES AND ROUTES OF HUMAN EXPOSURE	FOCUS OF NATIONAL ACTION PLAN	STATUS OF NATIONAL ACTION PLAN DEVELOPMENT
Octachlorostyrene (OCS)	EPA's concern about OCS is primarily due to its persistence and bioaccumulation in the environment, and its toxicity to aquatic organisms.	Little is known about the potential human toxicological effects of OCS. Data from animal studies indicate damage to liver, thyroid, and kidneys. Ecological effects: EPA believes that since OCS is structurally similar to HCB, it can reasonably be anticipated to have a similar ecotoxicological profile. Adverse effects on fish have also been predicted by use of chemical structure activity analysis.	OCS is thought to be an inadvertent byproduct in processes that combine carbon and chlorine at high temperatures, such as magnesium production and the commercial production of chlorinated solvents. Potential human exposure pathways: ingestion of contaminated fish, inhalation, absorption through the skin.	EPA's strategic approach for OCS is to develop a better understanding of the chemical's sources, releases, and potential for exposure, and to promote voluntary pollution prevention efforts where appropriate.	EPA intends to release the final National Action Plan for Octachlorostyrene in 2003.
Polychlorinated Biphenyls (PCBs)	PCBs are a group of synthetic organic chemicals that were manufactured in large quantities in the United States from 1929 until the ban of their manufacture in 1977. PCBs are very persistent in the environment, and can be found in aquatic wildlife at concentrations 100 million times greater than the concentration in the surrounding water.	Health effects: liver, thyroid, dermal and ocular changes, immunotoxicity, neuro-developmental changes, reduced birth weight, reproductive toxicity, and cancer. Ecological effects: A large body of laboratory and field studies shows that PCBs are causally linked to adverse health effects in wildlife. Adverse effects include: immunological, neurological, reproductive, and developmental effects and cancer (in laboratory animals). Wildlife affected include: whales, dolphins, seals and sea lions, polar bears, fish-eating birds, and freshwater and marine fish.	The major source of PCB release to the air, land, and water in the United States has been calculated to be the redistribution of the PCBs that are already present in soil, water and, indirectly, sediment. Next in significance as ongoing sources may be certain area sources emitting volatile PCBs – such as PCB transformer storage lots, sludge drying beds, and landfills – that may be emitting PCBs in quantities higher than previously suspected. Main route of human exposure: consumption of PCB-contaminated foods, especially meat, dairy products, poultry, and fish.	Priority activities for PCBs include: 1) promoting the voluntary decommissioning of PCB-containing electrical equipment; 2) remediating PCB-contaminated sites and sediments; 3) gathering data on PCB sources and routes of exposure; 4) enhancing fish and wildlife consumption advisories and communicating to citizens, especially those at high risk, ways to reduce exposure to PCB contamination; 5) building the capacity of other countries to comply with international agreements and improve their management of PCB risks. PCBs are also listed under the Stockholm Convention on Persistent Organic Pollutants (POPs) and the Long Range Transport of Air Pollution (LRTAP) POPs Protocol. See Chapter 6 for more information.	EPA is currently preparing to release its draft National Action Plan for PCBs for public comment.

PBT OR PBT GROUP	DESCRIPTION	HUMAN HEALTH AND ECOLOGICAL EFFECTS	SOURCES AND ROUTES OF HUMAN EXPOSURE	FOCUS OF NATIONAL ACTION PLAN	STATUS OF NATIONAL ACTION PLAN DEVELOPMENT
Pesticides	Aldrin, chlordane, dieldrin, DDT, endrin, heptachlor, mirex, and toxaphene are persistent organic pesticides that were once widely used in large quantities in the United States. EPA cancelled the registration of these pesticides in the U.S. during the 1970s and 1980s after finding evidence that they cause adverse environmental and human health effects.	Human health effects: probable human carcinogen; damage to reproductive, nervous, and digestive systems. Ecological effects: Detectable quantities of these pesticides have been found within a wide variety of animal species, and in some cases, at concentrations that have been known to pose serious risks to wildlife. Adverse effects include: shortened lifespan, reproductive problems, effects on liver function, and changes in appearance or behavior. Wildlife affected include: mammals, birds, fish, and shellfish.	Unused, uncollected stocks in the U.S.; continued use abroad; continued emissions from pesticides built up in soil and sediment. Current human exposure to these pesticides occurs mainly through the food chain, and for the most exposed populations, is probably due to the consumption of contaminated fish.	EPA is focusing on the following priorities for addressing these pesticides: 1) preventing accidental releases of remaining pesticide stocks; 2) facilitating the remediation or containment of non-point and reservoir sources of pesticides; 3) reducing human exposure through risk communication and outreach; 4) working internationally to reduce or phase out production of these substances; and 5) continuing to monitor for pesticides in humans, wildlife, and all relevant environmental media. These pesticides are also listed under the Stockholm Convention on Persistent Organic Pollutants (POPs) and the Long Range Transport of Air Pollution (LRTAP) POPs Protocol. See Chapter 6 for more information.	EPA intends to release the final National Action Plan for the Level I Pesticides in 2003.